

Claims

1. Process for coating surfaces of metallic substrates, in particular of parts, profiles or/and strips, preferably those based on aluminium, magnesium or/and steel which are optionally precoated with at least one
5 metallic coating such as e.g. a zinc layer or with at least one zinc-containing alloy layer, with an organic, anionically, cationically or/and radically curable anticorrosive composition, characterised in that
- the anticorrosive composition is a dispersion or solution containing at least two components selected from the group of monomers, oligomers and
10 polymers with a total content in the range from 50 to 95 wt.%, which are least partially anionically, cationically or/and radically curable,
- wherein a content of at least one monofunctional monomer or/and oligomer in the range from 1 to 58 wt.% is included herein,
- wherein the anticorrosive composition additionally contains at least
15 one photoinitiator for anionic, cationic or/and radical crosslinking with a content in the range from 0.5 to 22 wt.%, if electron beam radiation is not used,
- together with a first organic corrosion inhibitor in particular with a content in the range from 0.05 to 6 wt.%,
- 20 optionally at least one further organic or/and inorganic corrosion inhibitor with a total content in the range from 0.1 to 12 wt.%,
- optionally at least one hardener for a chemical postcure with a content in the range from 0.05 to 8 wt.%,
- optionally up to 35 wt.% of additive(s)
- 25 and optionally water or/and at least one organic solvent in a total content of 0.01 to 5 wt.%,

- relative in each case to the solids contents in wt.%,
wherein the anticorrosive composition is applied to the metallic surfaces in a wet film thickness in the range from 0.5 to 25 μm , optionally dried and is then anionically, cationically or/and radically cured to form an anticorrosive coating, wherein the anticorrosive coating displays a dry film thickness in the range from 0.4 to 20 μm and a chemical resistance of over 20 MEK cycles, determined in the MEK test in accordance with ECCA standard T11 with methyl ethyl ketone.
2. Process for coating surfaces of metallic substrates, in particular of parts, profiles or/and strips, preferably those based on aluminium, magnesium or/and steel, which are optionally precoated with at least one metallic coating such as e.g. a zinc layer or with at least one zinc-containing alloy layer, with an organic, anionically, cationically or/and radically curable anticorrosive composition, characterised in that before coating with a first organic anticorrosive composition, no pretreatment coat, such as e.g. one based on chromate, phosphate, complex fluoride, silane or/and siloxane, is applied to the metallic surfaces, that the anticorrosive composition is a dispersion or solution which is applied directly to the metallic surfaces in a wet film thickness in the range from 0.4 to 25 μm , is optionally dried and is then anionically, cationically or/and radically cured to form an anticorrosive coating which displays a dry film thickness in the range from 0.4 to 20 μm , wherein the anticorrosive coating preferably achieves a flexibility and bond strength of $\leq T3$, determined by means of a T-bend test in accordance with ECCA standard T7 on hot-galvanised precoated steel sheets of 0.3 mm thickness organically coated in a film thickness of 8 μm .

3. Process according to claim 1 or 2, characterised in that at least two components selected from the group of monomers, oligomers and polymers, which are at least partially anionically, cationically or/and radically curable, are added to the anticorrosive composition, wherein the content of monomers is in the range from 0 to 60 wt.%, the content of oligomers is in the range from 0 to 60 wt.% and the content of polymers is in the range from 10 to 70 wt.%, wherein on the one hand at least one monomer or/and at least one oligomer and on the other hand at least one polymer is present.
4. Process according to one of the preceding claims, characterised in that monomers or/and oligomers based on unsaturated, optionally aliphatic or/and aromatic compounds, such as unsaturated aliphatic acrylates for example, are added to the anticorrosive composition.
5. Process according to one of the preceding claims, characterised in that at least one anionically, cationically or/and radically polymerisable monomer or/and oligomer is added to the anticorrosive composition, selected from the group of compounds based on acrylate, methacrylate, polyester or/and polyurethane, preferably those based on benzyl, butyl, diols, diacrylate, ethyl, formal acrylate, glycol, hexyl, isobornyl, methyl, propyl or/and styrene.
6. Process according to one of the preceding claims, characterised in that at least one anionically, cationically or/and radically polymerisable monomer or/and oligomer is added to the anticorrosive composition, selected from the group of compounds comprising butanediol diacrylate, diethylene glycol diacrylate, dipropylene glycol diacrylate, 2-ethylhexyl acrylate, hexanediol dicyl acrylate, hydroxypropyl

methacrylate, isobornyl acrylate, isobornyl methacrylate, polyethylene diacrylate, triethylol propane formal acrylate, trimethyl propane triacrylate, trimethylol propane formal acrylate, triethylol propane acrylate, trimethylol propane acrylate and tripropylene glycol diacrylate.

5

7. Process according to one of the preceding claims, characterised in that at least one flexibilising resin or/and at least one modified flexibilising resin is additionally added to the anticorrosive composition, in particular at least one based on unsaturated aliphatic polymers such as e.g. those based on acrylate, methacrylate, polyester or/and polyurethane.

10

8. Process according to one of the preceding claims, characterised in that at least one coupling polymer is additionally added to the anticorrosive composition, in particular at least one based on phosphoric acid esters such as e.g. those with polymers based on acrylate, epoxide, methacrylate, polyester, polyurethane or/and copolymers thereof.

15

9. Process according to one of the preceding claims, characterised in that at least one base polymer based on acrylate, epoxide, methacrylate, polyester, polyurethane or/and copolymers thereof is added to the anticorrosive composition.

20

10. Process according to one of the preceding claims, characterised in that the dispersion or solution of at least one photoinitiator is added to the anticorrosive composition, based on compounds selected from the group comprising amino ketones, benzoin ethers, benzophenones, dimethyl ketals, glyoxylates, hydroxyketones, hydroxyphenones, isopropyl ethers, metallocenes, organic iodine compounds, phenyl ketones, phenyl propanes, phosphine oxides and derivatives thereof, in order to allow an anionic, cationic or/and radical cure.

25

30

11. Process according to one of the preceding claims, characterised in that at least one crosslinking agent is added to the anticorrosive composition, based on isocyanate, isocyanurate, melamine resin or/and compounds which can release isocyanate or isocyanurate at elevated temperature, such as e.g. TDI, MDI, HDMI or/and HDI, in particular a water-dispersible polymerisable postcuring compound, in order to allow a chemical postcure, which is preferably intensified by heating.
12. Process according to one of the preceding claims, characterised in that at least one first organic corrosion inhibitor is added to the anticorrosive composition, selected from the group of compounds based on amines, derivatives of an organic acid such as e.g. dicarboxylic acid derivatives, thiols and conductive polymers, in particular based on succinic acid derivatives, ethyl morpholine derivatives, polyamine fatty acid derivatives or/and triazole derivatives.
13. Process according to one of the preceding claims, characterised in that at least one further organic or/and inorganic corrosion inhibitor is added to the anticorrosive composition, selected from the group based on anticorrosive pigments and compounds of titanium, hafnium, zirconium, carbonate, ammonium carbonate, amines, amine derivatives, derivatives of an organic acid, thiols or/and conductive polymers, wherein the anticorrosive pigments are preferably those based on silica(s), oxide(s) or/and silicate(s).
14. Process according to one of the preceding claims, characterised in that corrosion inhibitors are added to the anticorrosive composition in a ratio of organic to inorganic corrosion inhibitors in the range from 1 : 8 to 1 : 20.

15. Process according to one of the preceding claims, characterised in that at least one additive is added to the anticorrosive composition, such as e.g. at least one wetting agent, defoaming agent, lubricant, bonding agent, pigments, flow control agents, agents to increase reactivity, surface additives to increase scratch resistance, thixotropic auxiliary agents or/and examples for substrate wetting such as are used in particular for bonding to electrodeposition coatings.
16. Process according to one of the preceding claims, characterised in that the anticorrosive composition contains at least one lubricant selected from the group of compounds based on graphite, polyethylene, polypropylene, polytetrafluoroethylene, silane, siloxane and wax, selected in particular from crystalline microwaxes, silanes or/and polysiloxanes.
17. Process according to one of the preceding claims, characterised in that the anticorrosive composition contains as additive at least one pigment selected from the group of compounds based on coloured pigment, metal pigment, oxide, phosphate, phosphide, phosphosilicate, silicate, electrically conductive pigment and coated pigment and selected in particular from the group comprising aluminium, aluminium alloys, iron alloys, iron hydroxide, iron oxide, iron phosphate, iron phosphide, graphite, silica, modified silica, optionally modified aluminium silicate, alkaline earth silicate or aluminosilicate, hypostoichiometric electrically conductive oxide, carbon black, zinc and more highly corrosion-resistant aluminium- or/and zinc-containing alloy.
18. Process according to one of the preceding claims, characterised in that on application the anticorrosive coating displays a viscosity in the range

from 80 to 20000 mPa•s, in particular on metal strip in the range from 350 to 10000 mPa•s, measured at a temperature of 25°C with a Haake VT 500 rotational viscometer with an MV DIN measuring cylinder in accordance with DIN 53019.

5

19. Process according to one of the preceding claims, characterised in that on application the anticorrosive composition displays a temperature in the range from 5 to 90°C.
- 10 20. Process according to one of the preceding claims, characterised in that the anticorrosive composition is applied to the metallic surface by pouring without or with a knife, spraying, atomisation, dipping or/and rolling.
- 15 21. Process according to one of the preceding claims, characterised in that surfaces consisting of aluminium, aluminium-containing alloys, chromium, chromium alloys, magnesium alloys, stainless steel, steel, zinc, zinc-containing alloys, tin or/and tin-containing alloys are coated.
- 20 22. Process according to one of the preceding claims, characterised in that the wet film of the anticorrosive composition is dried at temperatures in the range from 30 to 95°C, preferably by heating in an oven, inductive drying, IR irradiation, NIR irradiation or/and microwave irradiation.
- 25 23. Process according to one of the preceding claims, characterised in that the largely or completely dry film of the anticorrosive composition is irradiated with UV radiation, e.g. a mercury vapour lamp, in particular in the wavelength range from 180 to 700 nm and is partially, largely or completely crosslinked in this way.

24. Process according to one of the preceding claims, characterised in that the anticorrosive composition is selected in terms of double bonds of the monomers, oligomers or/and polymers and the content of monomers, oligomers or/and polymers and in terms of the duration, intensity and wavelength of the UV radiation such that a polymeric network having a medium-sized distance between crosslinking points is formed which at the same time has high flexibility and high chemical resistance.
25. Process according to one of the preceding claims, characterised in that the anticorrosive composition and the anionically, cationically or/and radically cured dry film produced therewith contains at least one hardener, such that the dry film, optionally after being heated to at least 60°C, is chemically postcured.
26. Process according to one of the preceding claims, characterised in that the substrate coated with the anticorrosive coating can be coated with at least one further paint-like composition, lacquer, paint or/and adhesive.
27. Process according to one of the preceding claims, characterised in that the anticorrosive coating applied to the metallic body is formed with the substrate, in particular a metal sheet, wherein the anticorrosive coating remains largely or entirely undamaged.
28. Process according to one of the preceding claims, characterised in that the formed substrate in the form of a formed, cut or/and stamped metal sheet coated with the anticorrosive coating is joined to another construction element by clinching, gluing, welding or/and at least one other joining process.

29. Process according to one of the preceding claims, characterised in that the metallic surface is cleaned or/and pickled before application of the pretreatment primer coat and optionally rinsed thereafter at least once with water or an aqueous solution.
30. Process according to one of the preceding claims, characterised in that the solution or dispersion is applied to a metallic strip carried on a conveyor belt system, in particular to a strip that has just been coated with aluminium, with an aluminium-containing alloy or with a zinc-containing alloy.
31. Organic, anionically, cationically or/and radically curable anticorrosive composition, characterised in that it is a dispersion or solution containing at least two components selected from the group of monomers, oligomers and polymers with a content in the range from 50 to 95 wt.%, which are least partially anionically, cationically or/and radically curable,
- wherein a content of at least one monofunctional monomer or/and oligomer in the range from 1 to 58 wt.% is included herein,
- wherein the anticorrosive composition contains at least one photoinitiator for anionic, cationic or/and radical crosslinking with a content in the range from 0.5 to 22 wt.%, if electron beam radiation is not used,
- together with a first organic corrosion inhibitor in particular with a content in the range from 0.05 to 6 wt.%,
- optionally at least one hardener with a content in the range from 0.05 to 8 wt.% for a chemical postcure,
- optionally at least one further organic or/and inorganic corrosion inhibitor in particular with a content in the range from 0.1 to 12 wt.%,

- optionally up to 35 wt.% of additive(s) such as e.g. additives for substrate wetting such as in particular for bonding to electrodeposition coatings, wetting agents, defoaming agents, lubricants, bonding agents, pigments, flow control agents, agents to increase reactivity, surface additives
- 5 to increase scratch resistance or/and thixotropic auxiliary agents,
and optionally a total of 0.01 to 5 wt.% of water or/and at least one organic solvent,
relative in each case to solids contents in wt.%.
- 10 32. 1 Organic, anionically, cationically or/and radically cured anticorrosive coating, which displays a dry film thickness in the range from 0.4 to 20 μm , characterised in that when applied directly to a metallic surface, without the interposition of a pretreatment coat, it displays a flexibility and bond strength of $\leq T3$, in particular of $\leq T2$ or even of $\leq T1$ -
- 15 determined by means of a T-bend test in accordance with ECCA standard T7.
- 20 33. Organic, anionically, cationically or/and radically cured anticorrosive coating on a metallic substrate, which displays a dry film thickness in the range from 0.4 to 20 μm , characterised in that when applied directly to a metallic surface, without the interposition of a pretreatment coat, it displays a bond strength of $\leq Gt 3$, determined by means of a cross-hatch adhesion test in accordance with DIN EN 2409 and by tearing off a firmly adhering strip of adhesive tape from the cross-hatch area with
- 25 visual assessment of the cross-hatch area and its flaking.
- 30 34. Organic, anionically, cationically or/and radically cured anticorrosive coating on a metallic substrate, which displays a dry film thickness in the range from 0.4 to 20 μm , characterised in that when applied directly to a metallic surface, without the interposition of a pretreatment coat, it

displays a corrosion resistance, tested as subsurface migration at a scratch, of ≤ 5 mm, preferably ≤ 3 mm, determined in a salt spray test SS to DIN 50021 for 150 h or for 360 h, wherein the anticorrosive coating remains free from blisters.

5

35. Organic, anionically, cationically or/and radically cured anticorrosive coating on a metallic substrate, which displays a dry film thickness in the range from 0.4 to 20 μm , characterised in that when applied directly to a metallic surface, without the interposition of a pretreatment coat, it displays abrasion-free and fault-free cups in a determination of the cupping indentation (cup drawing) by the Erichsen test method using an Erichsen 142-20 universal sheet metal and strip testing machine with deep-drawing cup tool with a punch diameter of 33 mm and a pressing rate of 750 mm/min on blanks of 60 mm diameter made from metallic sheets coated with the anticorrosive coating.

15

36. Organic, anionically, cationically or/and radically cured anticorrosive coating on a metallic substrate, which displays a dry film thickness in the range from 0.4 to 20 μm , characterised in that when applied directly to a metallic surface, without the interposition of a pretreatment coat, it displays a chemical resistance of over 20 MEK cycles, determined in the MEK test in accordance with ECCA standard T11 with methyl ethyl ketone.

20

37. Organic, anionically, cationically or/and radically cured anticorrosive coating on a metallic substrate, which displays a dry film thickness in the range from 0.4 to 20 μm , characterised in that it displays a chemical resistance of over 50 MEK cycles, determined in the MEK test in accordance with ECCA standard T11 with methyl ethyl ketone.

30

38. Organic cured anticorrosive coating on a metallic substrate, which displays a dry film thickness in the range from 0.1 to 20 μm , characterised in that it displays a chemical resistance of over 50 MEK cycles – determined in the MEK test in accordance with ECCA standard T11 with methyl ethyl ketone – and that it displays an elasticity and bond strength in the indentation test to DIN EN ISO 1520 with a ball indentation of at least 6 mm.
39. Use of the substrates coated by the process according to one of claims 1 to 30 in the steel industry, in automotive construction or/and in aircraft construction, in particular in standard car production, as wire, wire winding, wire mesh, sheet metal, cladding, screening, car body or car body part, part of a vehicle, trailer, caravan or flying body, covering, housing, lamp, light, traffic light element, item of furniture or furniture element, element of a domestic appliance, frame, profile, moulding with complex geometry, crash barrier element, radiator element or fencing element, bumper, part consisting of or having at least one pipe or/and one profile, window, door or bicycle frame or as a small component such as e.g. a screw, nut, flange, spring or spectacle frame.
40. Use of the anticorrosive coating produced by the process according to one of claims 1 to 30 as a protective coating in forming or/and joining, as corrosion protection for surfaces or in the vicinity of edges, seams or/and weld seams, as protection in place of cavity sealing or/and seam sealing, in particular for vehicle construction or aircraft construction.